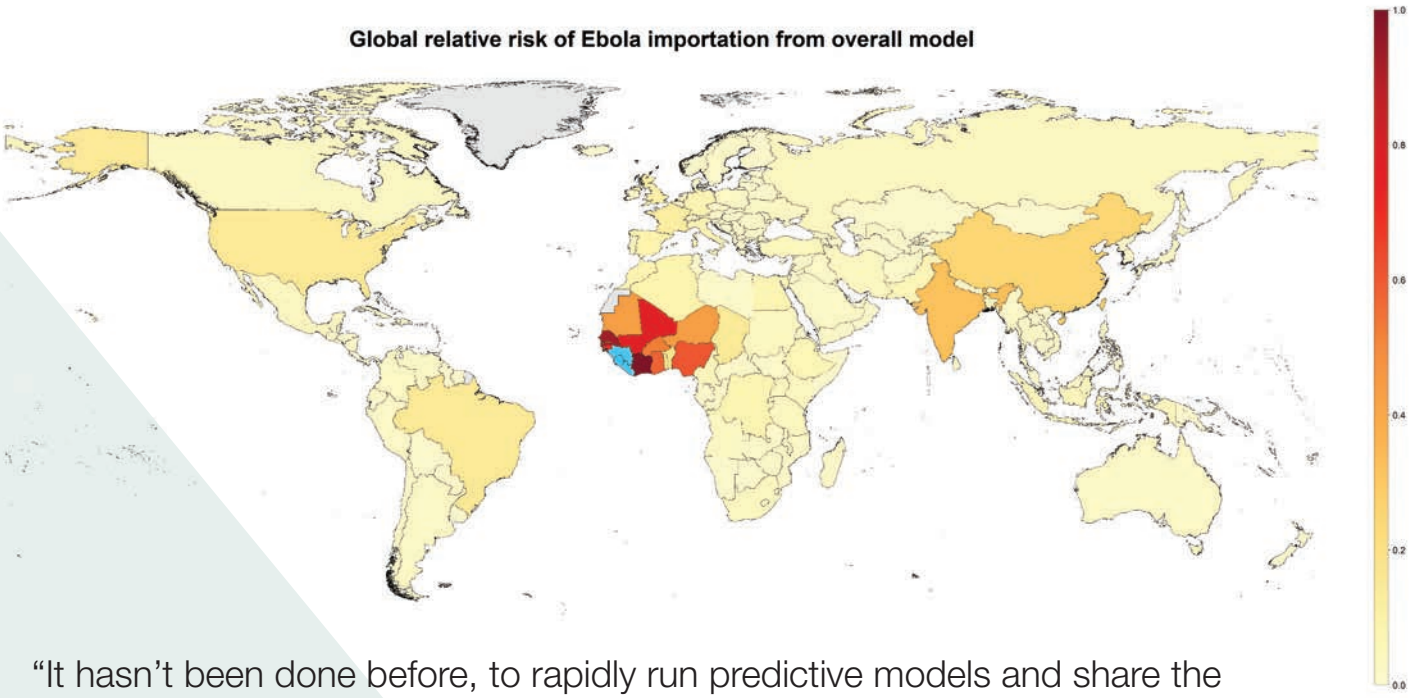
Using the Step Change in Data Availability and Digital Tools for Predictive Mapping

Predicting the Geographic Spread of the Ebola Virus in West Africa:

University of Oxford



"It hasn't been done before, to rapidly run predictive models and share the results with people who need to make urgent decisions. Moving from static maps to automatically updated maps that really use the step change in data availability and digital tools. This gives us an online automated system that predicts where cases will pop up next." NICK GOLDING POST-DOCTORAL RESEARCHER AT SEEG

The project has set up an automated pipeline to feed in new data as it arrives, presenting it in a readable format. In an outbreak situation you need to make decisions quickly, so when a new case is apparent then data is rapidly put into the system and provides new mapping. The process adds up the risk and combines it with the relative risk in other locations. This information is useful for decision makers. The idea was to target surveillance. 'It's all about how people move around and how that affected the progress of the epidemic.'

Weekly WHO updates in terms of cases and additional data to understand in general how people move in West Africa came from data from mobile phone records from the Flowminder Foundation and Andy Tatem at Southampton University. The ELRHA funding has allowed the project to develop the software. Previously Nick Golding noted that there were lots of theoretical models floating around but that this software can rapidly run predictive models which can be use in other preparedness situations in the future.

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Why risk maps?

Excerpt from Blog March 2015

As well as new cases appearing in districts immediately adjacent to those already affected, new cases rapidly started appearing in other parts of these countries too. Notably, the disease took only a short period of time to establish in the capital cities of Liberia and Sierra Leone, areas which subsequently became the most intense foci of transmission. Cases were also imported into other countries in the region, though fortunately these were brought under control relatively quickly.

Looking at maps of affected regions over time during this phase of the epidemic (like these: http://www.bbc.co.uk/news/world-africa-28755033) it's pretty hard at first to work out why some districts saw new outbreaks starting and others didn't. It wasn't just diffusing through space, but hopping to new locations. Since each new outbreak is started by an infected person travelling to an unaffected area and infecting more people, it's obvious that human movements patterns are what drive the geographic spread of this disease (and of many others).

If we had been able to precisely predict where the new cases were going to pop up it would have been much easier for the international community to prioritise where to put resources, build treatment centres and nip outbreaks in the bud before they gained momentum.

Of course that's easier said than done. We have pretty poor knowledge of how people move around even in more economically developed regions, and even less in developing countries, like those most affected by the current epidemic. In practice, we have to rely on mathematical models to draw information from other places (such as countries where population movements have been studied) and make predictions about how people move, and where cases are likely to be imported next.

Fortunately, numbers of new cases in the three core affected countries have been in decline since the end of last year and it's now clear that the disease is being brought under control. Whilst the epidemic is no longer expanding in its geographic distribution, understanding where importations are likely to occur is still really important. Since it only takes a single Ebola case to trigger a new outbreak, the end game of the epidemic – moving from few to zero cases – is likely to be a long and drawn out process. Rapidly identifying and safely treating the last Ebola cases will be crucial to speeding up that process so that the affected countries can start rebuilding.

Our aim is therefore to develop risk maps to help those involved in the current effort decide where to prioritise surveillance efforts so that they can prevent the disease from flaring up in new places.

Project partner bios

The Ebola risk mapping project is led by and hosted at the Spatial Ecology and Epidemiology Group (SEEG) at the University of Oxford (http://seeg.zoo.ox.ac.uk/).

The Flowminder Foundation is a registered non-profit entity that aims at improving public health outcomes providing and using new data sources. This includes important work regarding our understanding of human mobility in resource poor settings (http://www.flowminder.org/).

WorldPop is a project partner aiming to provide an open access archive of spatial demographic datasets to support health applications. Maps are disseminated through their online platform: http://www.worldpop.org.uk/data/.

Programme Name:

Predicting the geographic spread of Ebola virus disease in West Africa

Key information

Grant awarded: £95,179
Lead organisation: University of Oxford
Partnering organisation(s):
Spatial Ecology and Epidemiology Group (SEEG)
Project length: 2014-15
Health sector: Modelling
Study location: Oxford, UK

Principal Investigator(s)

Professor Simon Hay, University of Oxford

Purpose

The geographic spread of Ebola virus disease (EVD) during the ongoing outbreak in West Africa has been driven by human movement within and between countries. Using data on human mobility in these countries to make quantitative predictions of disease spread will enable more rational deployment of resources as efforts are scaled to contain the epidemic.

Expected outcomes

High-resolution maps of EVD importation risk in West Africa developed and disseminated to WHO and authorised partners. These maps, along with relevant summary information (such as the health centres most likely to see new cases), have been continuously updated as data become available and automatically disseminated via an online geographic information system alongside other spatial information to guide control of the outbreak. These tools will also be useful to maintain vigilance as the epidemic comes under control.

Dissemination is already happening via WHO and their situation reports and can be seen here: http://seeg-oxford.github.io/ebola-spread/

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Managed by elrha